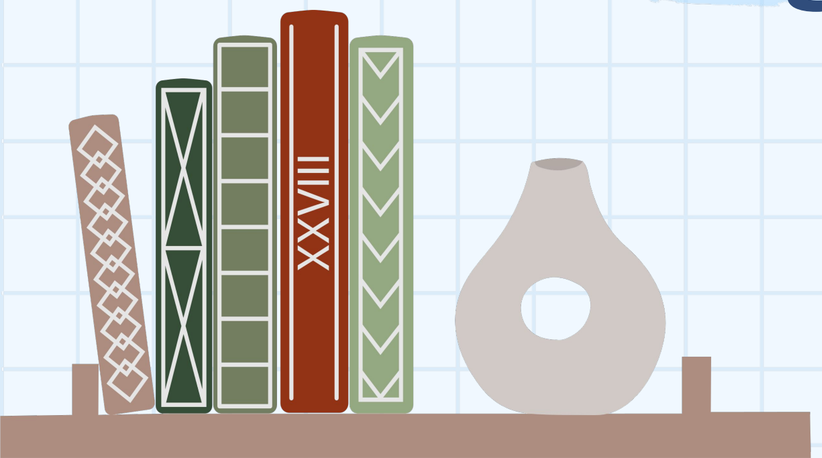
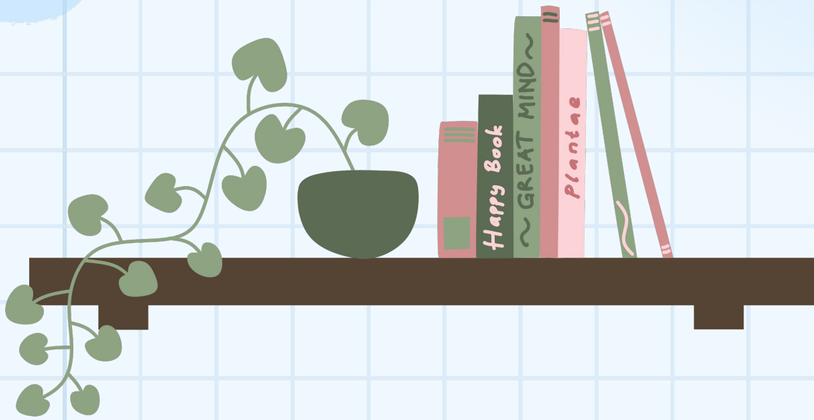
BS./BSC.

Applied AI and Data Science

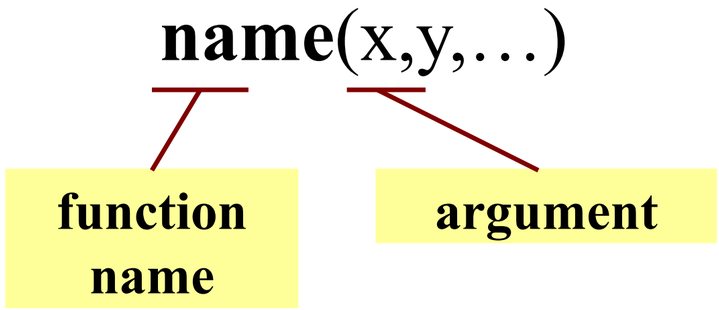
Algorithmic Thinking & its Applications





Function Calls

- Python supports expressions with math-like functions
  - A function in an expression is a *function call*
- **Function calls** have the form



- **Arguments** are
  - **Expressions**, not values
  - Separated by commas

Built-In Functions

- Python has several math functions
  - round(2.34)
  - max(a+3,24)

Arguments can be any **expression**

- You have seen many functions already
  - Type casting functions: int(), float(), bool()
- Documentation of all of these are online
  - https://docs.python.org/3/library/functions.html
  - Most of these are two advanced for us right now

Functions as Commands/Statements

- Most functions are expressions.
  - You can use them in assignment statements
  - **Example**: x = round(2.34)
- But some functions are **commands**.
  - They instruct Python to do something
  - Help function:
    help()
  - Quit function:
    quit()

These take no arguments

- How know which one? Read documentation.

Built-in Functions vs Modules

- The number of built-in functions is small
  - http://docs.python.org/3/library/functions.html
- Missing a lot of functions you would expect
  - **Example**: cos(), sqrt()
- **Module**: file that contains Python code
  - A way for Python to provide optional functions
  - To access a module, the import command
  - Access the functions using module as a *prefix*

Example: Module math

```
>>> import math
>>> math.cos(0) 1.0

>>> cos(0)
Traceback (most recent call last): File "<stdin>",

  line 1, in <module>

NameError: name 'cos' is not defined
>>> math.pi 3.141592653589793

>>> math.cos(math.pi)

-1.0
```

Example: Module math

```
>>> import math
>>>
>>> math.cos(0)
1.0
>>> cos(0)
Traceback (most recent call last): File "<stdin>", line 1, in <module>
NameError: name 'cos' is not defined
>>> math.pi 3.141592653589793
>>> math.cos(math.pi)
-1.0
```

To access math functions

Functions require math prefix!

Example: Module math

```
>>> import math
>>> math.cos(0)
1.0
>>> cos(0)
```

To access math functions

Functions require math prefix!

```
Traceback (most recent call last): File "<stdin>", line 1, in
<module> NameError: name 'cos' is not defined
```

```
>>> math.pi
3.141592653589793
>>> math.cos(math.pi)
-1.0
```

Module has variables too!

Example: Module math

```
>>> import math
>>> math.cos(0)
1.0

>>> cos(0)
Traceback (most recent call last): File
"<stdin>", line 1, in <module>
NameError: name 'cos' is not defined
    >>> math.pi
    3.1415926535897
    93

    >>>
    math.cos(math.pi)
    -1.0
```

To access math functions

Functions require math prefix!

Module has variables too!

Other Modules

- os
  - Information about your OS
  - Cross-platform features
- **random**
  - Generate random numbers
  - Can pick any distribution

Using the from Keyword

```
>>> import
math
>>> math.pi
3.141592653589793
>>> from math import pi
>>>
pi
3.141592653589793
>>> from math import *
>>> cos(pi)
-1.0
```

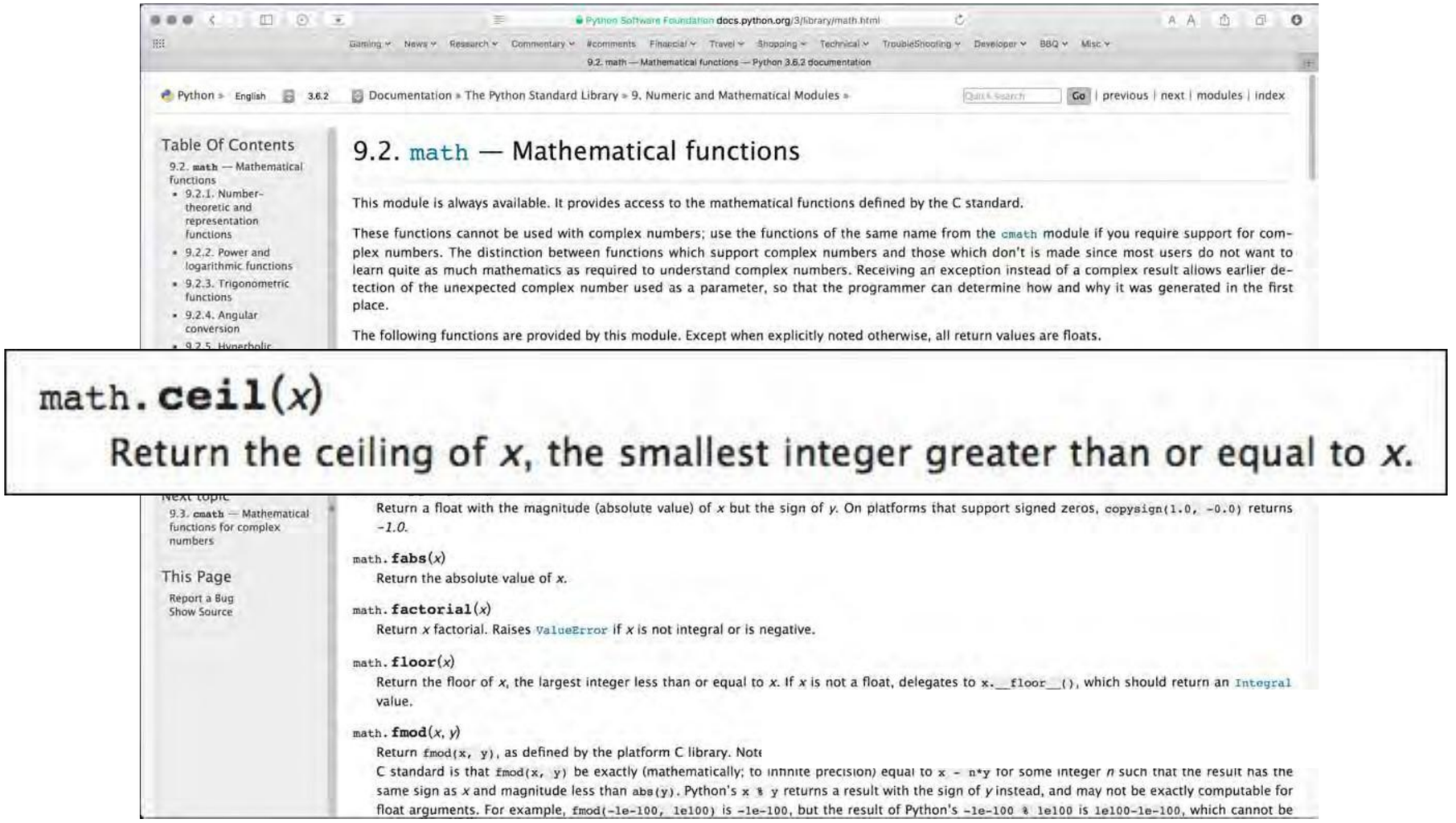
Must prefix with module name

No prefix needed for variable pi

No prefix needed for anything in math

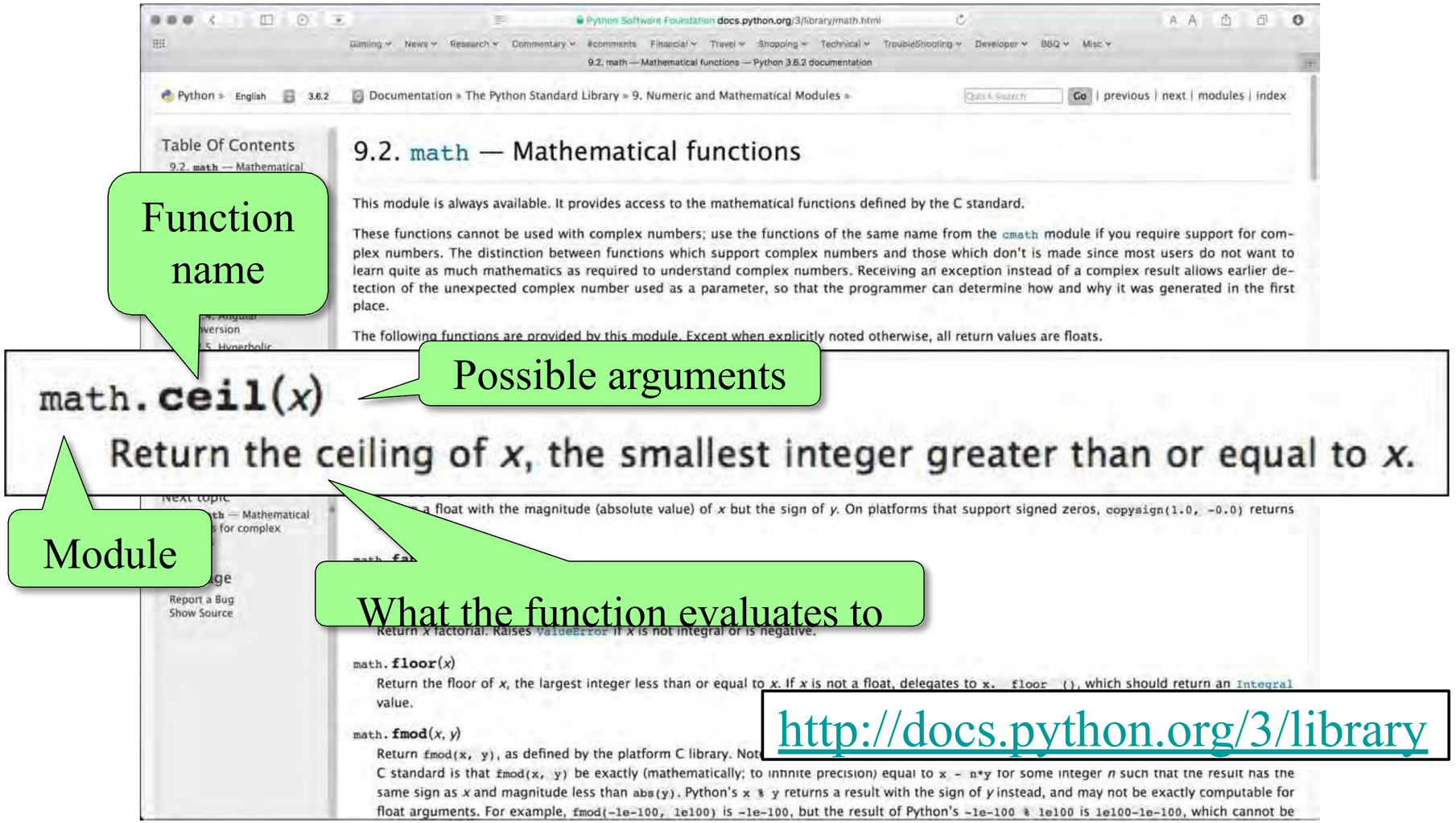
- Be careful using from!
- Using import is *safer*
  - Modules might conflict (functions w/ same name)
  - What if import both?

Reading the Python Documentation



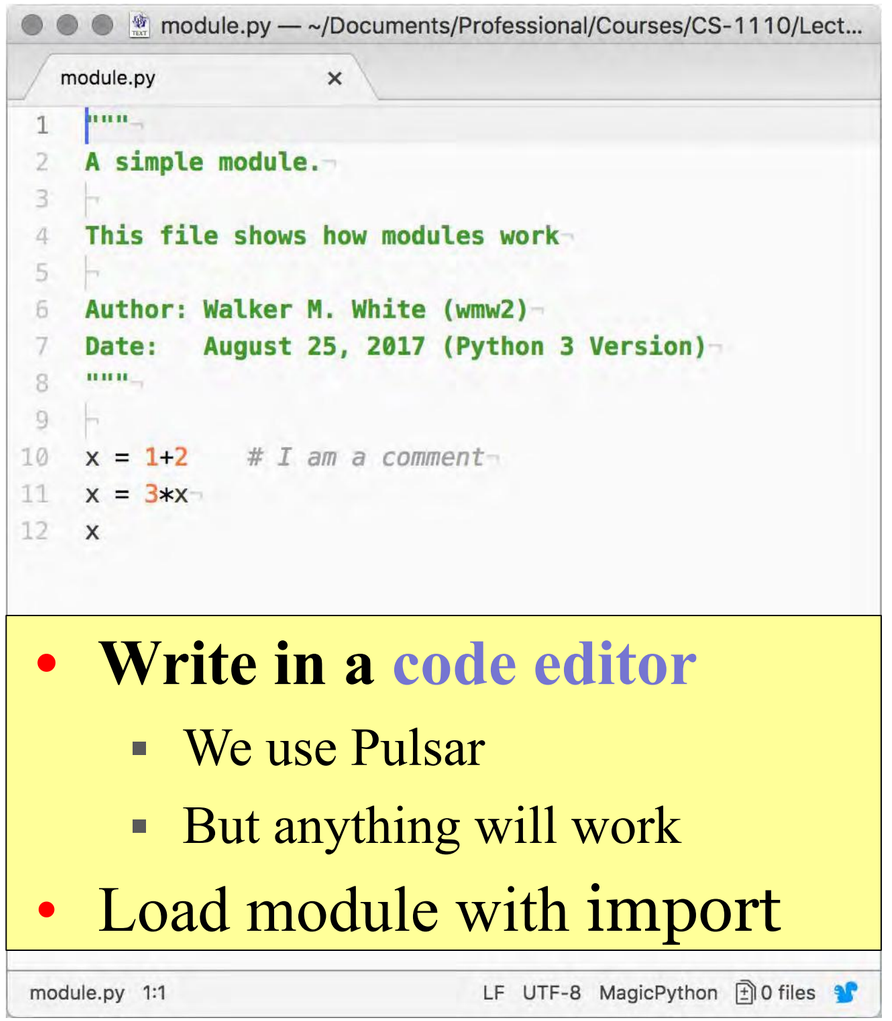
http://docs.python.org/3/library

Reading the Python Documentation



Interactive Shell vs. Modules

- Launch in command line
- Type each line separately
- Python executes as you type



- **Write in a code editor**
  - We use Pulsar
  - But anything will work
- Load module with import

Using a Module

Module Contents

```
""" A simple module.

This file shows how modules
work """

# This is a
comment x = 1+2
x =
3*x x
```

Using a Module

Module Contents

```
""" A simple module.

This file shows how modules
work """

# This is a
comment x = 1+2
x =
3*x x
```

Single line comment
(not executed)

Using a Module

Module Contents

```
""" A simple
module.
This file shows how modules
work """

# This is a
comment x = 1+2
x =
3*x x
```

Docstring (note the Triple Quotes)
Acts as a multiple-line comment
Useful for *code documentation*

Single line comment
(not executed)

Using a Module

Module Contents

```
""" A simple
module.
This file shows how modules
work """

# This is a
comment
x = 1+2
x = 3*x x
```

Docstring (note the Triple Quotes)
Acts as a multiple-line comment
Useful for *code documentation*

Single line comment
(not executed)

Commands
Executed on import

Using a Module

Module Contents

```
""" A simple
module.
This file shows how modules
work """

# This is a
comment
x =
1+2
x =
3*x x
```

Docstring (note the Triple Quotes)
Acts as a multiple-line comment
Useful for *code documentation*

Single line comment
(not executed)

Commands
Executed on import

Not a command.
import **ignores this**

Using a Module

Module Contents

```
""" A simple
module.
This file shows how modules
work """

# This is a
comment x = 1+2
x =
3*x x
```

Python Shell

```
>>> import
module
>>> x
```

Using a Module

Module Contents

```
""" A simple
module.
This file shows how modules
work """

# This is a
comment x = 1+2
x =
3*x x
```

Python Shell

```
>>> import module
>>> x
Traceback (most recent call
last): File "<stdin>", line 1, in
<module> NameError: name
'x' is not defined
```

Using a Module

Module Contents

```
""" A simple
module.
This file shows how modules
work """

# This is a comment

x =
1+2
x =
3*x x
```

"**Module data**" must be prefixed by module name

Python Shell

```
>>> import module
>>> x
Traceback (most recent call
last): File "<stdin>", line 1, in
<module> NameError: name
'x' is not defined
>>>
module.x 9
```

Using a Module

Module Contents Python Shell

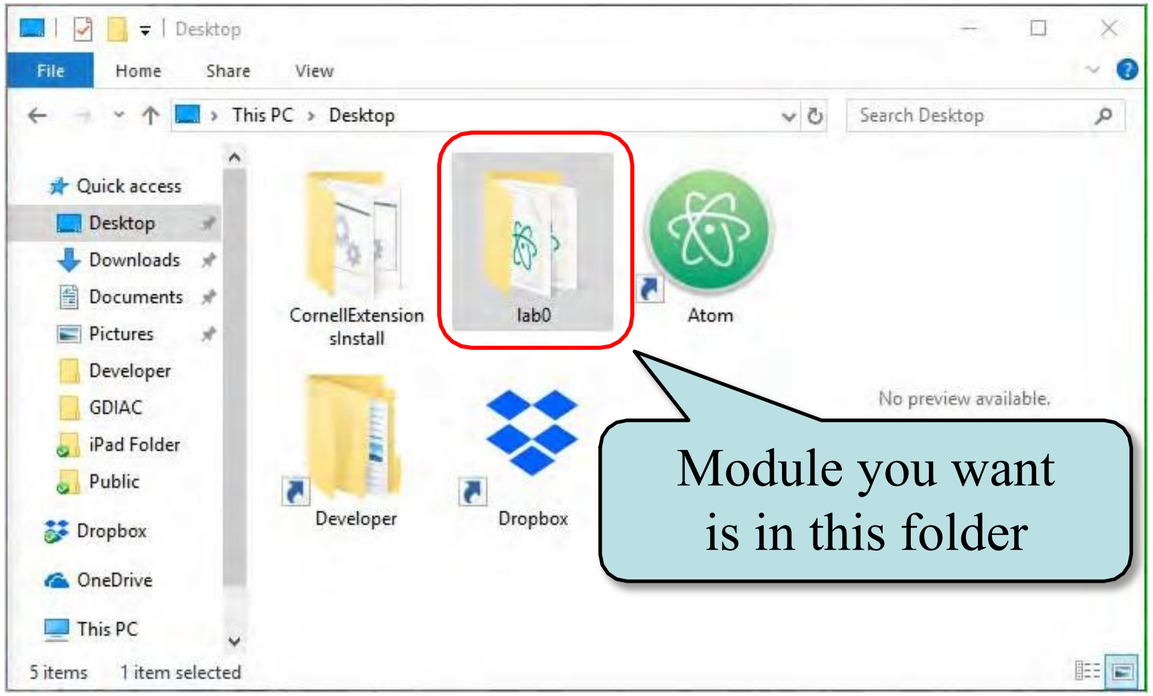
```
""" A simple
module.
This file shows how modules
work """

# This is a comment

x =
1+2
x =
3*x x
```

"**Module data**" must be prefixed by module name

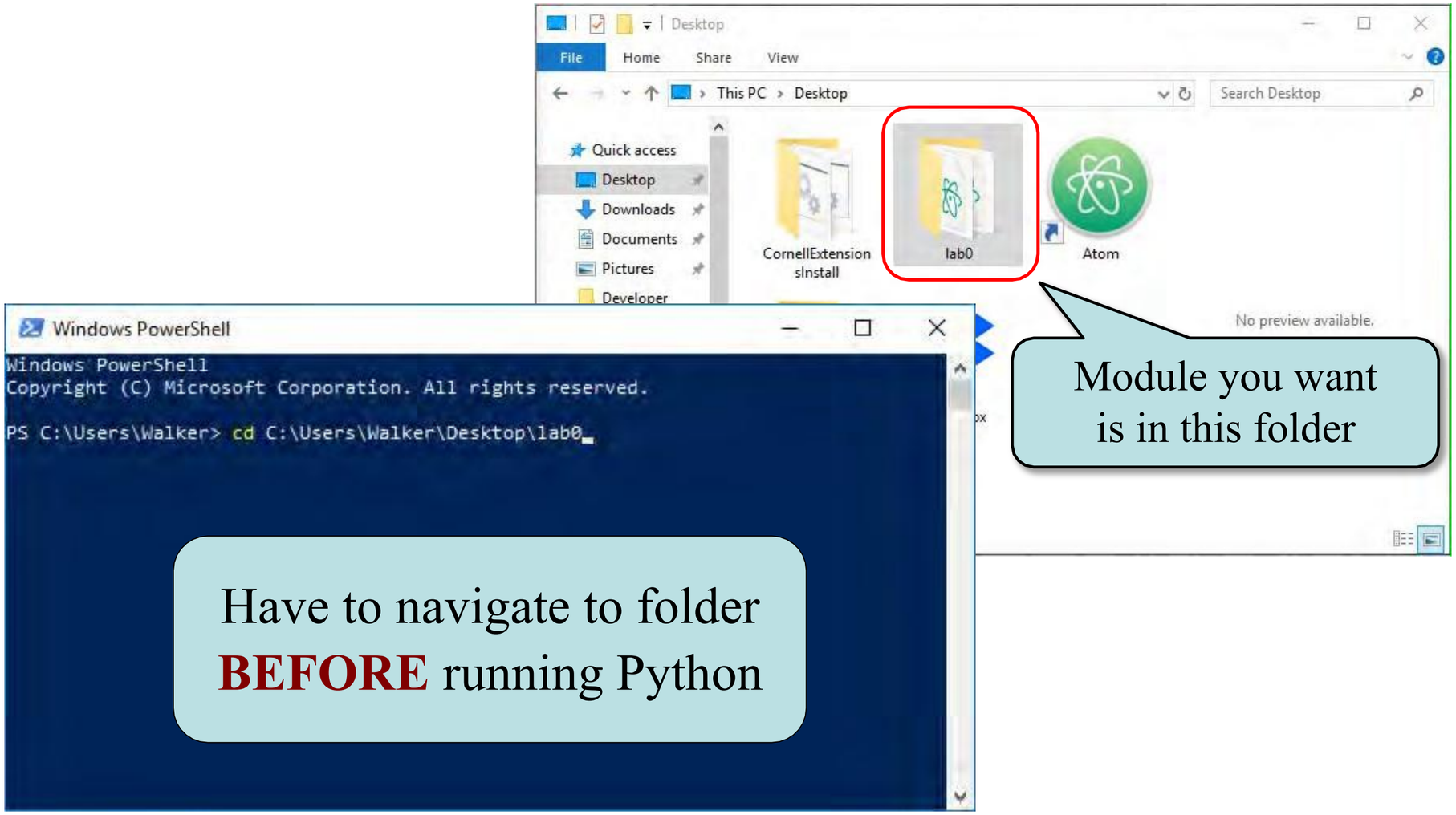
Prints **docstring** and module contents

```
>>> import module
>>> x
Traceback (most recent call
last): File "<stdin>", line 1, in
<module> NameError: name
'x' is not defined
>>>
module.x 9
>>> help(module)
```

Modules Must be in Working Directory!



Modules Must be in Working Directory!



Modules vs. Scripts

Module

- Provides functions, variables
  - **Example**: temp.py
- import it into Python shell

```
>>> import temp
>>>
temp.to_fahrenheit(100)
212.0
>>>
```

Script

- Behaves like an application
  - **Example**: helloApp.py
- Run it from command line:

  python helloApp.py

Modules vs. Scripts

Module

- Provides functions, variables
  - **Example**: temp.py
- import it into Python shell

```
>>> import temp
>>>
temp.to_fahrenheit(100)
212.0
>>>
```

Script

- Behaves like an application
  - **Example**: helloApp.py
- Run it from command line:

  python helloApp.py

Files look the same. Difference is how you use them.

Scripts and Print Statements

module.py

```
""" A simple module.

This file shows how modules
work """

# This is a
comment x = 1+2
x =
3*x x
```

script.py

```
""" A simple script.

This file shows why we use
print """

# This is a
comment x = 1+2
x =
3*x
print(x
)
```

Scripts and Print Statements

module.py **script.py**

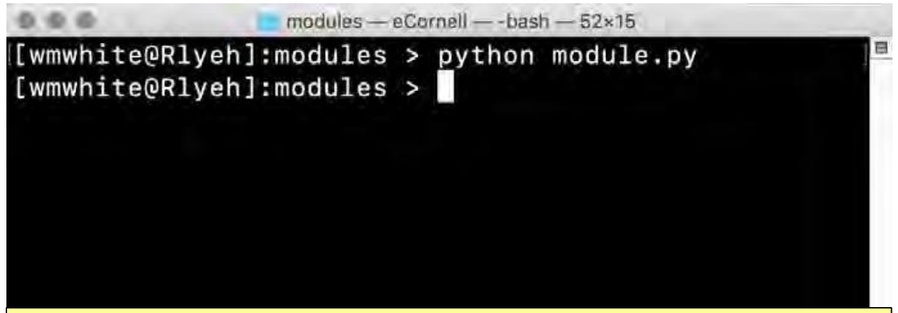
```
""" A simple module.
This file shows how modules work """

# This is a comment
x = 1+2
x = 3*x
x
```

```
""" A simple script.
This file shows why we use print """

# This is a comment
x = 1+2
x =
3*x
print(x
)
```

Only difference

Scripts and Print Statements

module.py script.py

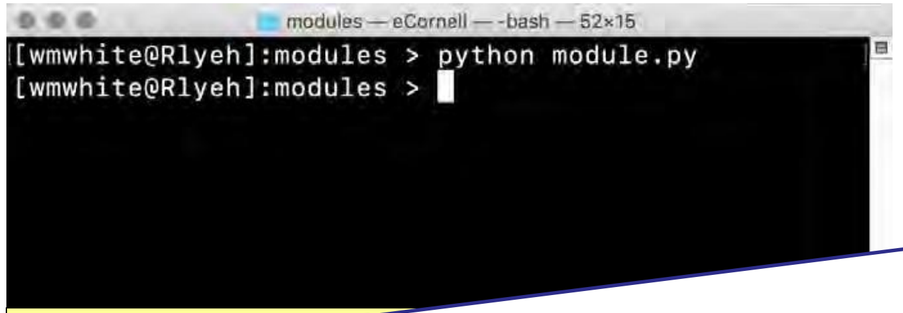


- Looks like nothing happens
- Python did the following:
  - Executed the assignments
  - Skipped the last line
    ('x' is not a statement)

- We see something this time!
- Python did the following:
  - Executed the assignments
  - Executed the last line
    (Prints the contents of x)

Scripts and Print Statements

module.py script.py



- Looks l
- Python
  - Execu ssignments
  - Skipped the last line
    (‘x’ is not a statement)

When you run a script’ only statements are exe cuted

his time!

following:

- Executed the assignments
- Executed the last line
  (Prints the contents of x)

User Input

```
>>> input('Type something')
Type somethingabc
'abc'

>>> input('Type something: ')
Type something: abc
'abc'
>>> x = input('Type something: ')
Type something: abc
>>> x
'abc'
```

No space after the prompt.

Proper space after prompt.

Assign result to variable.

Making a Script Interactive

```
"""
A script showing off input.

This file shows how to make a
script interactive.
"""

x = input("Give me a
something: ") print("You
said: "+x)
```

```
[wmw2] folder> python script.py
Give me something: Hello
You said: Hello
[wmw2] folder> python script.py
Give me something: Goodbye
You said: Goodbye
[wmw2] folder>
```

Not using the interactive shell

Numeric Input

- input returns a string
  - Even if looks like int
  - It cannot know better
- You must convert values
  - int(), float(), bool(), etc.
  - Error if cannot convert
- One way to program
  - But it is a *bad* way
  - Cannot be automated

```
>>> x = input('Number: ')
Number: 3
>>> x
'3'
>>> x + 1
TypeError: must be str, not int
>>> x = int(x)
>>> x+1
4
```

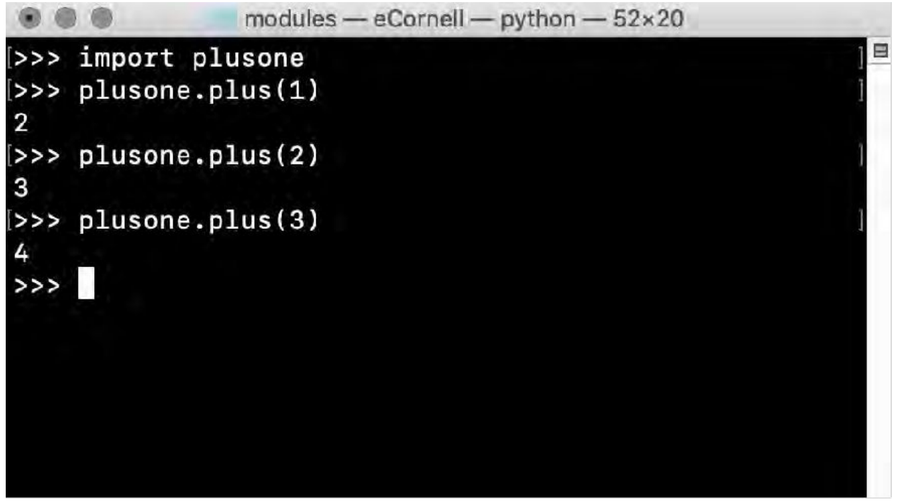
Value is a string.

Must convert to int.

Next Time: Defining Functions

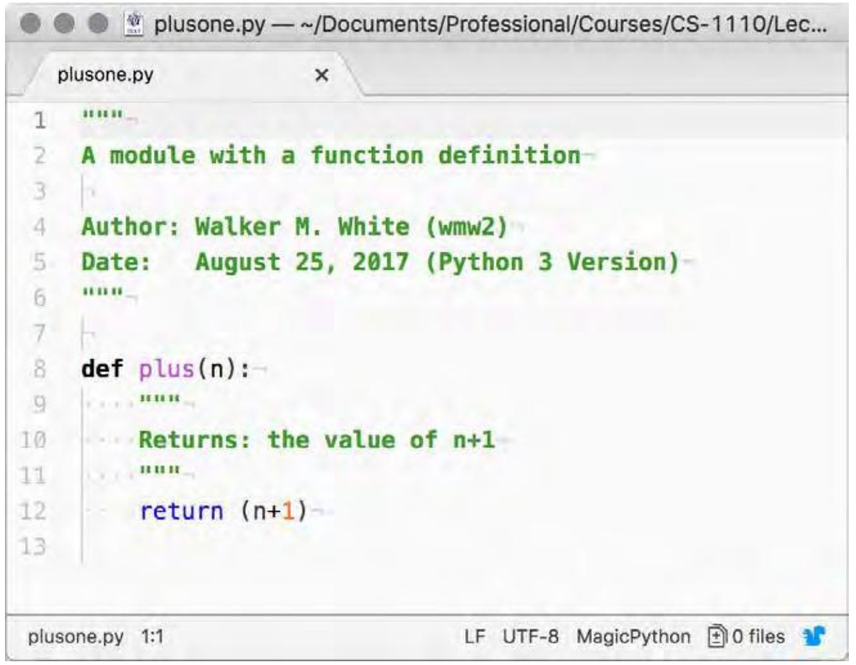
Function Call

- Command to **do** the function
- Can put it anywhere
  - In the Python shell
  - Inside another module



Function Definition

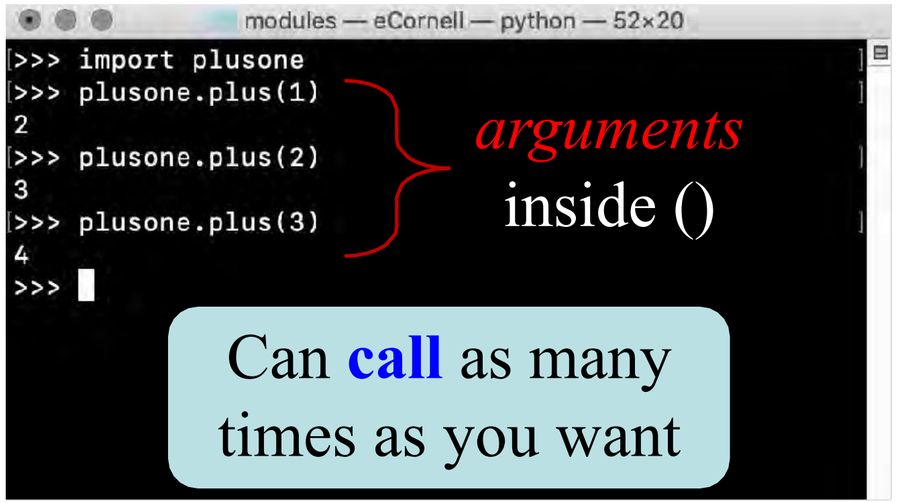
- Command to **do** the function
- Belongs inside a module



Next Time: Defining Functions

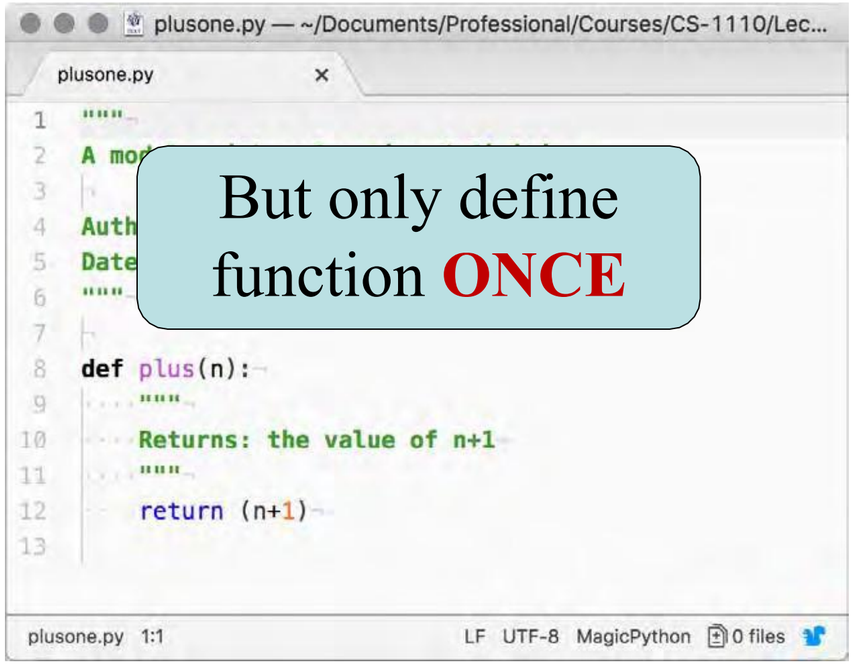
Function Call

- Command to **do** the function
- Can put it anywhere
  - In the Python shell
  - Inside another module



Function Definition

- Command to **do** the function
- Belongs inside a module



Thank you